Syndromic Surveillance and Risk Management Using Multiitem Gamma Poisson Shrinker

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Scientists at the Food and Drug Administration (FDA) have been exploring DuMouchels' automated and rapid Bayesian data mining techniques to systematically and rapidly screen the huge MedWatch database of voluntary reports for possible events of concern with existing and new drugs. The Multiitem Gamma Poisson Shrinker (MGPS) algorithm computes signal scores (SS) (adjusted ratios of observed-to-expected drug event reports, O/E) from application of a statistical model with stratification to control for potential confounding by age, gender, or reporting period. MGPS systematically generates reliable, consistent, redundant, and replicable early signals from the data while minimizing random patterns. Signals are generated without linkage to the corresponding, unfeasible to match systematically, external exposure data or adverse event background information. MGPS computes SS for pairs and for higher order (e.g., triplet, quadruplet) combinations of drugs and events that are significantly more frequent than their pairwise associations would predict. Only a relatively small proportion (3.4%) of all distinct drug-event pairs in the database result in large SS (>2.0). These signals capture a high proportion (23%) of the total number of drug-event pairs reported, greatly facilitating more focused follow-up, evaluation, and risk management. In addition to detecting possible serious single-drug adverse event problems, MGPS detects possible synergistic interactions between drugs (drug interactions) and among adverse events (syndromes). Examples of syndromes automatically detected without the need of case definitions include the following death-associated quadruples having rhabdomyolysis as an event: blood creatine phosphokinase increased–blood myoglobin increased–myoglobinuria present–rhabdomyolysis, with 5 reports, mostly explained by pairwise interactions; and hypotension–myocardial infarction–renal failure acute–rhabdomyolysis, with 4 reports, mostly unexplained by pairwise interactions.

A Comparison of Military Surveillance Systems for Early Detection of Naturally Occurring and Bioterrorism-Based Epidemics of Febrile Respiratory Illness

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To evaluate the performance of the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE), an electronic health indicator surveillance system, it was compared to a more traditional, active system operated by the Naval Health Research Center (NHRC). The NHRC system has research assistants at military treatment facilities (MTFs) to record the number of recruits who meet a case definition of febrile respiratory illness (FRI). Data are forwarded to the NHRC, where weekly rates of FRI per MTF are calculated. The ESSENCE system groups already collected diagnostic data in the form of *International Classification of Diseases, 9th Revision* (*ICD-9*) codes into syndromic categories. The ESSENCE server receives updated *ICD-9* data every 8 hours; however, submission of this information from the MTFs ranges from 1 to 3 days. A subset of codes for diagnoses and symptoms that could constitute an FRI was generated from the ESSENCE data. The correlation of weekly FRI case detection between the two systems from June 1998 to January 2002 was evaluated in nine MTFs. The surveillance data from the four MTFs with the highest degree of correlation was further compared to assess whether both systems

detected the same epidemics and how quickly they did so. When using autoregessive modeling, ESSENCE did not always detect high peaks following slow increases. Other statistical methods are being developed to correct this omission. Despite this, there is strong evidence from some MTFs that ESSENCE can capture surveillance trends similar to those seen in the distinctly different type of system operated by NHRC.